MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PMT0201 – MATHEMATICS II
(Foundation in Information Technology)

14 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **6 pages**, excluding the cover page and formula list.
2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the **answer booklet** provided. All necessary working steps **MUST** be shown.
4. You are required to write proper steps to obtain **MAXIMUM** marks.

FORMULAE LIST - PMT0201

$\cos^2 A + \sin^2 A = 1$ $\quad$ $\sec^2 A = 1 + \tan^2 A$ $\quad$ $\csc^2 A = 1 + \cot^2 A$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$
$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\cos 2A = 2\cos^2 A - 1 = 1 - 2\sin^2 A = \cos^2 A - \sin^2 A$$
$$\sin 2A = 2\sin A \cos A$$
$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$2\sin A \cos B = \sin(A+B) + \sin(A-B)$$
$$2\cos A \cos B = \cos(A+B) + \cos(A-B)$$
$$2\sin A \sin B = \cos(A-B) - \cos(A+B)$$

$$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A-B}{2} \quad , \quad \sin A - \sin B = 2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2} \quad , \quad \cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

$$\sin\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{2}}$$
$$\cos\frac{A}{2} = \pm\sqrt{\frac{1+\cos A}{2}}$$
$$\tan\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{1+\cos A}} = \frac{1-\cos A}{\sin A} = \frac{\sin A}{1+\cos A}$$

$s = r\theta$ $\quad$ $A = \frac{1}{2}r^2\theta$

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$A = \frac{1}{2}ab\sin C$$
$$A = \sqrt{s(s-a)(s-b)(s-c)} \quad , \quad s = \frac{1}{2}(a+b+c)$$

QUESTION 1 [10 MARKS]

a) Figure 1 shows a sector ABC of a circle, with center A and radius 6 cm.

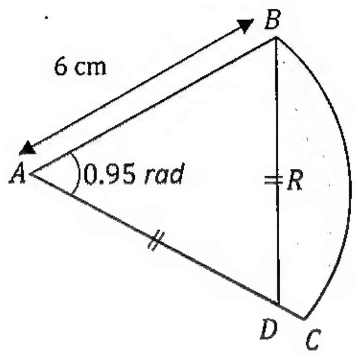


Figure 1

i) Find the angle ADB in degree. [1 mark]

ii) Find the length of AD. [1 mark]

iii) Find the area of shaded region R. [3 marks]

b) Find the exact value of $\cot\left[\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)\right]$. Show all steps. [2.5 marks]

c) Determine the amplitude, period, phase shift and vertical shift of the following function:

$$f(x) = -\frac{2}{5}\cos\left(2x+\frac{\pi}{4}\right)+3$$ [2.5 marks]

Continued…

QUESTION 2 [10 MARKS]

a) Solve $2\sin^2\theta - 3\sin\theta - 2 = 0$ for $0^0 \le \theta \le 360^0$. [3 marks]

b) Express $2\sin\theta + 3\cos\theta$ in the form $R\sin(\theta+\alpha)$, where $0^0 \le \theta \le 360^0$. [2 marks]

c) Given $w = -\frac{1}{2} + \frac{\sqrt{3}}{2}i$.

i) Find the **polar form** of w. [2.5 marks]

ii) Given $z = \sqrt{3}\left(\cos 300^0 + i\sin 300^0\right)$, find the polar form of $\frac{z}{w}$. [1 mark]

iii) Use De Moivre's Theorem to find w^2.
Leave your answer in the form $a+bi$ where $a,b \in \Re$.
Express a and b in exact values. [1.5 marks]

Continued…

QUESTION 3 [10 MARKS]

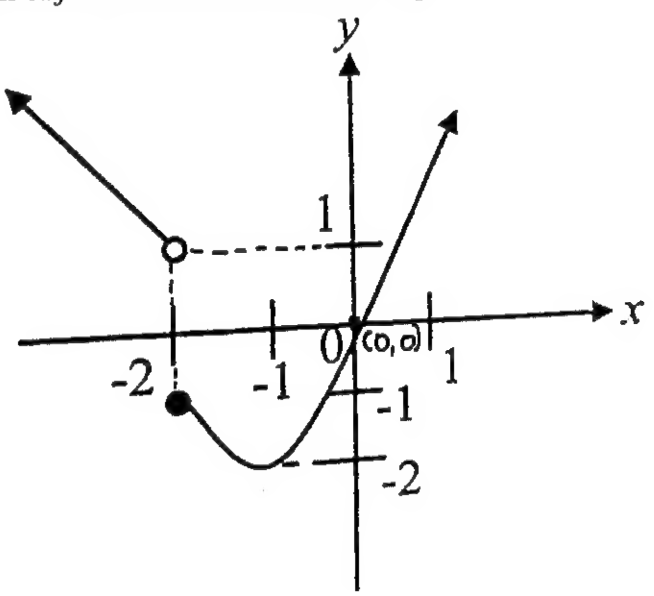
a) Evaluate the following limits:

i) $\lim_{x \to -2} \frac{4x+6}{5-2x}$ [1 mark]

ii) $\lim_{x \to 1} \frac{x^2-6x+5}{x-1}$ [2 marks]

iii) $\lim_{x \to 6} \frac{\sqrt{x-2}-2}{x-6}$ [3 marks]

b) Use the graph of f below to find the following:



i) $\lim_{x \to -2} f(x)$

ii) $\lim_{x \to 0} f(x)$

iii) $\lim_{x \to -\infty} f(x)$

[1.5 marks]

Continued…

c) Given $f(x)=\begin{cases} x+2k & , \quad x\le 1 \\ kx^2+x+1 & , \quad x>1 \end{cases}$.

Find:

i) $\lim\limits_{x\to 1^-} f(x)$

ii) $\lim\limits_{x\to 1^+} f(x)$

Hence, find the value of k if $\lim\limits_{x\to 1} f(x)$ exist. [2.5 marks]

Continued…

QUESTION 4 [10 MARKS]

a) Use **formal definition of derivative** to differentiate the function $f(x) = x^2$ with respect to x.

Hint: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

[2.5 marks]

b) Find the **first derivative** of the following functions:

i) $y = \frac{4x + 5x^4}{x^2}$ [1.5 marks]

ii) $y = (x^2 + 5x)^5$ [1 mark]

iii) $y = x^5 e^x$. Factorize your final answer. [2 marks]

c) Given $f(x) = x^3 - 12x$ for $-2 \le x \le 3$.

i) Find the critical values.

ii) Determine the absolute minimum and maximum values.

[3 marks]

Continued…

QUESTION 5 [10 MARKS]

a) Compute the integral $\int_1^2 \left(\frac{5}{x} + 2e^x\right) dx$.

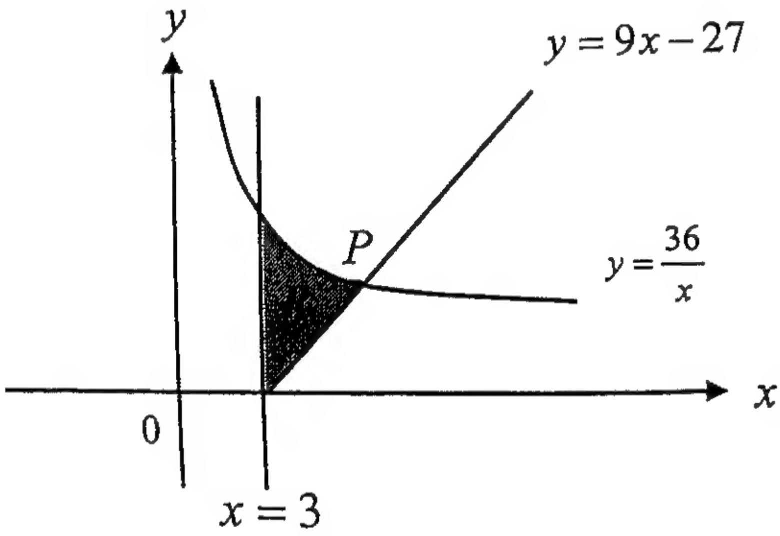
Leave your final answer correct to two decimal places. [2 marks]

b) Use **integration by parts** to find $\int \left(xe^{x+5}\right) dx$. [2 marks]

c) Given $\int_1^5 f(x)\,dx = 6$.

Find the value of p if $\int_1^5 \left[f(x) + p\right] dx = 30$. [2 marks]

d) The figure below shows a region R bounded by $y = \frac{36}{x}$, $y = 9x - 27$ and $x = 3$.



i) The curves $y = \frac{36}{x}$ and $y = 9x - 27$ intersect at P, show that the coordinates of P is $(4,9)$.

ii) Find the area of shaded region R. [4 marks]

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